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## Nanotechnology boosts anticancer drug cocktail many times over

Writte by Jim Lewis the 22/04/2011

Using nanoparticles for drug delivery, particularly to treat cancer, has been under development for several years. **Liposomes** were one of the earliest and simplest types of nanoparticles used for cancer drug delivery, and were often not much more complex than vesicles of lipid bilayer, typically less than 200 nm in diameter, encapsulating an anticancer drug. Now more complex and sophisticated nanoparticles promise to be much more effective in treating cancer. We thank **KurzweilAI** for pointing to this news release from Sandia National Laboratories and the University of New Mexico "**Sandia and UNM lead effort to destroy cancers: Boosting medicine with nanotechnology strengthens drug cocktail many times over**"

Melding nanotechnology and medical research, Sandia National Laboratories, the University of New Mexico, and the UNM Cancer Research and Treatment Center have produced an effective strategy that uses nanoparticles to blast cancerous cells with a mélange of killer drugs.

In the cover article [[abstract](#)] of the May issue of *Nature Materials*, available online April 17 , the researchers describe silica nanoparticles about 150 nanometers in diameter as honeycombed with cavities that can store large amounts and varieties of drugs.

"The enormous capacity of the nanoporous core, with its high surface area, combined with the improved targeting of an encapsulating lipid bilayer [called a liposome], permit a single 'protocell' loaded with a drug cocktail to kill a drug-resistant cancer cell," says Sandia researcher and UNM professor Jeff Brinker, the principal investigator. "That's a millionfold increase in efficiency over comparable methods employing liposomes alone — without nanoparticles — as drug carriers."

The nanoparticles and the surrounding cell-like membranes formed from liposomes together become the combination referred to as a protocell: the membrane seals in the deadly cargo and is modified with molecules (peptides) that bind specifically to receptors overexpressed on the cancer cell's surface. (Too many receptors is one signal the cell is cancerous.) The nanoparticles provide stability to the supported membrane and contain and release the therapeutic cargo within the cell.

A current Food and Drug Administration-approved nanoparticle delivery strategy is to use liposomes themselves to contain and deliver the cargo. In a head-to-head comparison of targeted liposomes and protocells with identical membrane and peptide compositions, Brinker and colleagues report that the greater cargo capacity, stability and targeting efficacy of protocells leads to many times greater cytotoxicity

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Another advantage to protocells over liposomes alone, says lead author Carlee Ashley, a Harry S. Truman post-doctoral fellow at Sandia's California site in Livermore, is that liposomes used as carriers need specialized loading strategies that make the process more difficult. "We've demonstrated we can just soak nanoparticles to load them with unique drug combinations needed for personalized medicine. They effectively encapsulate toxins as well as siRNA [ribonucleic acid] that silence expressions of proteins."

RNA, the biological messenger that tells cells which proteins to manufacture, in this case is used to silence the cellular factory, a way of causing apoptosis or cell death. "Si" is short for "silence."

The lipids also serve as a shield that restricts toxic chemotherapy drugs from leaking from the nanoparticle until the protocell binds to and takes hold within the cancer cell. This means that few poisons leak into the system of the human host, if the protocells find no cancer cells. This cloaking mitigates toxic side effects expected from conventional chemotherapy.

Instead, the particles — crafted small enough to float under the radar of the liver and other cleansing organs — can circulate harmlessly for days or weeks, depending on their engineered size, seeking their prey. ...

"Proteins modified with a targeting peptide that binds to a particular carcinoma exhibit a 10,000-fold greater affinity for that cancer than for other unrelated cells," Ashley said. ...

The method may be commercially available in five years, researchers estimate.

During the past few weeks several very different types of nanoparticles have been reported as showing great promise, and these will be the subject of additional posts soon. Nanomedicine, and especially targeted drug delivery, is looking like an area where accelerating progress is demonstrating the value of investing in building increasingly complex nanostructures. Will this trend continue until we reach the point of atomically precise manufacture of medical nanorobots?

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